and on its intestinal flora, are all treated. Finally, to every section or subdivision of a section a description of the physical, chemical, and biological methods of investigation is appended.

That we have much yet to learn concerning many of the natural processes involved is apparent from a perusal of such a section as that on the heating and firing of hay. This appears to take place in three stages, a first in which the temperature rises to 45–50° C., a second in which the temperature rises from 50° C. to 70° C., and a third which proceeds above 70° C. The first two stages are caused by the activities of micro-organisms involving processes of decomposition and oxidation ("thermophilic" bacteria being active between 50° and 70° C.), but the cause in the third stage of the production of heat above 70° C. and ultimately culminating in ignition is not so obvious. It is probably a physico-chemical process due to the production of carbonaceous and other matters which adsorb, condense, and oxidise the hydrogen, marsh and other inflammable gases, which have resulted from decomposition in the earlier stages, and cause their ignition, much in the same way as spongy platinum causes the ignition of hydrogen.

Nor is the subject-matter strictly confined to "bacteriological" details, but if others are of importance in relation to the general treatment of a subject, they are included. Thus, as regards milk, not only is the importance of streptococci discussed, but the nature and significance of the cellular elements which are constantly present in less or greater number are reviewed. These cellular elements when in small numbers have generally been considered to be leucocytes, when in large numbers as pus cells and to be abnormal, but investigation has shown that under normal conditions and with perfectly healthy cows these cells are occasionally present in enormous numbers; all this is summarised.

Considerable space is also devoted to the chemistry of the changes and decompositions which occur in the various processes, and while the vegetable micro-organisms claim most attention, some reference is made to the protozoa and higher animal organisms, *e.g.* earth-worms and their importance. Had the work been compiled later, doubtless more space would have been devoted to the protozoa, the treatment of which as it stands is too brief.

The book, which is not illustrated, is clearly printed on good paper with numbered lines for facility of reference, and concludes with very full and complete indexes of authors and subjects.

(2) This little book, by the same author as the preceding, gives in the briefest outline a general account of bacteriological methods followed by a series of simple practical lessons on the bacteriology and biochemistry of milk, manure, and soil. The student who works through these lessons will certainly gain a considerable amount of knowledge of the subjects treated, and will be ready to undertake more advanced work. Many illustrations are given, most of which are good and appropriate, though the methods of inoculating tubes given in Figs. 19 and 24 seem clumsy and archaic. R. T. H.

OUR BOOK SHELF.

British Rainfall, 1910. *On the Distribution of Rain in Space and Time over the British Isles during the Year* 1910, *as recorded by nearly* 5000 *Observers in Great Britain and Ireland, and discussed with Articles upon Various Branches of Rainfall Work.* By Dr. H. R. Mill. The fiftieth annual volume. Pp. 112+328. (London: Edward Stanford, 1911.) Price 10*s.*

THE author remarks in his report to the trustees that the chief object of the rainfall organisation is to present the results of the labours of the observers in the best and most useful way. An inspection of the volume under review leaves no doubt that this desirable aim has been fully attained. As in former years, the work is divided into three principal sections, including, *inter alia*, (1) organisation and special articles, (2) monthly and seasonal rainfall and its relation to the average and heavy falls of rain (see NATURE, February 2), and (3) general table of annual rainfall and number of rain-days at 4874 stations. The cartographic treatment has been carried further than in previous volumes; the maps referring to heavy falls on rainfall days are of exceptional interest, and include a series of remarkable thunderstorms which occurred chiefly in the south of England from June 5 to 10, with a coloured map (as frontispiece) showing the distribution of torrential rains in the Thames valley on June 9.

The most laborious of the changes this year is the more satisfactory arrangement of the stations of the general table for England and Wales in river basins, although for convenience of reference the counties are retained as the units. This forms the subject of a special article, illustrated by maps of each division showing the county boundaries and watershed lines. The treatment of the stations in Scotland and Ireland has been postponed. Another laborious piece of work has been the introduction of a new rainfall average based on the thirty-five years 1875–1909. For the British Isles generally and for Ireland this makes practically no change, so far as the annual totals are concerned, from the thirty years' average. For England the new average is 5 per cent. less, in Wales 3 per cent. less, and in Scotland 4 per cent. more.

In a special article on the greatest rainfall which may occur on the wettest day of the year it is shown that during the last forty-seven years falls of 4 inches have occurred in a great number of counties, even exceeding 6 inches in a few. Another useful article on the rain-gauge in theory and practice will remove several of the difficulties usually experienced by beginners of rainfall observations. We cannot conclude this notice without expressing regret that this very valuable organisation is not self-supporting, and that a considerable financial burden has to be borne by the director.

Partridges and Partridge Manors. By Captain A. Maxwell. Pp. xii+327. (London: A. and C. Black, 1911.) Price 7*s.* 6*d.* net.

WHAT the author accomplished with the assistance of Mr. George Malcolm in 1910 for the grouse he has succeeded in doing single-handed for the partridge in 1911, and the praise we felt bound to accord to his former effort we have pleasure in re-echoing in the case of the present beautifully illustrated volume. It contains, in fact, practically all that the sportsman ought to know with regard to the plump brown game-bird of our stubbles, and much that ought to interest the ornithologist. For Captain Maxwell appears to be a good field observer himself, and has likewise availed himself largely of the stores of information

possessed by the better class of gamekeepers. Among such information, it may be mentioned, is a heavy and apparently conclusive indictment against the hedgehog as a game-poacher of the blackest dye.

Partridge-preserving the author considers to be decidedly beneficial to the farmer, as it not only brings money into country districts, which otherwise would be spent elsewhere, but it provides him with "a small machine [in the shape of the partridge] which turns noxious weeds and useless insects into a valuable food." After discussing the economical question in chapter i., the author takes the natural history of the partridge as the subject of chapter ii. Here we are told at the outset that "no fewer than 152 species of partridges and their affinities" are recognised by ornithologists—a statement difficult to understand owing to the ambiguity of the term "affinities." A few other minor criticisms might be made on this chapter, but in the succeeding chapters, dealing with rearing, driving, and shooting partridges, the author appears to be thoroughly in his element and a master of his subject. Every sportsman should buy a copy of the book. R. L.

Practical Drawing. A Preliminary Course of Work for Technical Students. By T. S. Usherwood. Pp. viii+163. (London: Macmillan and Co., Ltd., 1910.) Price 2*s*.

THIS useful little manual provides an excellent course of instruction in instrumental drawing, very suitable for the junior classes of technical institutes. The beginner is first shown the use of the rule and callipers in the making of dimensioned hand sketches of simple objects. Then full explanations are given of the manipulation and handling of drawing instruments, including tee and set squares, in the production of accurate work to scale. Facility in the use of instruments is acquired along with a working knowledge of geometrical principles, by the plotting of lines, angles, figures, vectors, and the drawing of simple mechanical and architectural details.

The subsequent work in plane geometry includes the construction of scales, circles, triangles, polygons, geometrical patterns, and similar figures; also graphing on squared paper, the calculation of areas, and the plotting of the paths of points moving under geometrical or mechanical constraint. The author wisely devotes a chapter to the method of representing solid objects by plans and elevations, and by metric projections to scale. The book is provided with an index, and the student with answers to the numerical exercises. The author is evidently an experienced teacher. He supplies good examples in great variety. The scheme of instruction is a sound and desirable one, and affords a thorough groundwork for subsequent study.

Die praktische Bodenuntersuchung. By Prof. E. Heine. Pp. xii+162+plate. (Berlin: Gebrüder Borntraeger, 1911.) Price 3.50 marks.

WHILST there are many works in German dealing with the properties of soil from the purely scientific point of view, there is none, according to the author, that gives the practical farmer the kind of knowledge he wants in order to understand the nature of the soil and the processes going on therein. While it is not denied that a farmer can get on sufficiently well without this knowledge, nevertheless he will find not only a source of interest, but also of profit, in learning something about the fundamental properties and laws on which the cultural operations and the fertility relationships of the soil are based. The author therefore deals in successive chapters with the soil as a medium for plant growth, the physical properties, chemical composition, and biological relationships of soils, methods of classification and improvement. In the second part of the book the soils of North Germany are described, and instructions are given for the use of soil maps.

The information is clearly set out, and in its general style will appeal to the farm student and to the young farmer who has sufficient energy and interest to read after his day's work is done. Indeed, the information is better than the method: a book written for the same class of readers in England would be expected to give many more actual illustrations of the application of general principles than are here attempted. The reviewer's experience is that general principles as such have little meaning to the farm student, and copious illustrations are necessary to give point to them. The present book is deficient in this respect.

More stress might well have been laid on the part played by calcium carbonate in soil fertility. No soil deficient in calcium carbonate can be regarded as very satisfactory; vegetation relationships are markedly different according as calcium carbonate is present or not. Thus in the description of humus the differences between the various types is attributed to differences in air supply, the part played by calcium carbonate not being considered important. It is evident, also, that the German method of mechanical analysis is less satisfactory than our own, which would have formed the basis of several of the chapters in such a book.

But apart from these points the little book is very good, and conveys in simple language an accurate presentation of our present ideas on the soil.

E. J. R.

Conic Template. J. T. Dufton's design. For Junior Students of Conics. (London: Macmillan and Co., Ltd.) Price, nickel-plated metal, 4*d*. net; transparent celluloid, 8*d*. net.

STUDENTS of geometrical conics should not fail to provide themselves with this accurately made and handy little "Conic Template." By merely passing a pencil round its curved edges, a true ellipse, parabola, and hyperbola can be drawn, the three curves having closely related elements, which are specified in the instructions accompanying each instrument. The regular employment of accurate figures, instead of rough diagrams sketched freehand, will add interest to the work, and will materially assist in fixing on the mind of the student the forms and properties of these important curves.

How to become a Pharmacist in Great Britain. With Appendixes on Pharmaceutical Qualification in Ireland, Pharmaceutical Registration in the British Empire, Degrees in Pharmacy, and the Schedule of Poisons. Edited by John Humphrey. Pp. 52. (London: The Pharmaceutical Press, 1911.) Price 1*s*. net.

CLEAR and precise information is given here about each stage in the preparation for the work of a pharmaceutical chemist, from apprenticeship to the passing of the major examination of the Pharmaceutical Society. The appendixes give details as to the particular conditions under which qualification to practise pharmacy may be secured in Ireland and in other parts of the British Empire. The advice offered is sound and helpful; and the view throughout is to regard the work of the pharmacist as a branch of applied science needing the practice of scientific methods for its successful performance.